Exelon Generation

Byron Generating Station

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February 15, 2017

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United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Byron Station, Unit 2
Renewed Facility Operating License No. NPF-66
NRC Docket No. STN 50-455

Subject: Licensee Event Report (LER) No. 455-2016-001-01, Manual Reactor Trip Due to Circuit Breaker Failure that Caused Actuation of Feedwater Hammer Prevention System with Automatic Isolation of Feedwater to Two Steam Generators and Low Steam Generator Levels

Enclosed is Byron Station Licensee Event Report (LER) No. 455-2016-001-01 regarding loss of power to the Feedwater Hammer Prevention System that resulted in automatic isolation of Feedwater to steam generators and manual reactor trip. This condition is being submitted in accordance with 10 CFR 50.73, "Licensee Event Report System."

This LER is being supplemented to reflect that the Unit 2 Reactor Protection System was actuated by the manual reactor trip and the Auxiliary Feedwater system actuated automatically as expected. This information supports the initial determination that this event was reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) for any event or condition that resulted in manual or automatic actuation of any of the systems listed in 10 CFR 50.73(a)(2)(iv)(B).

There are no regulatory commitments in this report.

Should you have any questions concerning this submittal, please contact Mr. Douglas Spitzer, Regulatory Assurance Manager, at (815) 406-2800.

Respectfully,

Mark E. Kanavos
Site Vice President
Byron Generating Station

MEK/GC/sg

Enclosure: LER 455-2016-001-01

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Byron Generating Station

NRC FORM 366 (06-2016) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Byron Station – Unit 2	05000455	1 OF 3

4. TITLE

Manual Reactor Trip due to Circuit Breaker Failure that Caused Actuation of Feedwater Hammer Prevention System with Automatic Isolation of Feedwater to Two Steam Generators and Low Steam Generator Levels

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
10	12	2016	2016	- 001	- 01	02	15	2017	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
90%	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Douglas Spitzer - Manager, Byron Regulatory Assurance	(815) 406-2800

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EC	BKR	W120	Y	N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO		N/A	N/A	N/A

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On October 12, 2016 at 1338 hours, Byron Station Operations initiated a manual reactor trip of Unit 2 due to decreasing water levels in the loop B and loop C Steam Generators. A trip of a bus feed breaker resulted in the loss of power feed to multiple normally energized relays associated with the Feedwater (FW) Water Hammer Prevention System (WHPS) circuit, which resulted in automatic closure of related Feedwater Isolation Valves.

The apparent cause of the feed breaker trip was due to a manufacturing defect on the feed breaker amptector circuit board.

The corrective actions planned include revising refurbishment testing requirements for the main feed breaker and performing modifications in subsequent refuel outages to the FW Water Hammer Prevention System to address power supply single point vulnerability.

The Unit 2 Reactor Protection System was actuated by the manual reactor trip and the Auxiliary Feedwater system actuated automatically as expected. This condition is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) for any event or condition that resulted in manual or automatic actuation of any of the systems listed in 10 CFR 50.73(a)(2)(iv)(B).

NRC FORM 366A (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Byron Station – Unit 2	05000455	2016	- 001	- 01

NARRATIVE

A. Plant Operating Conditions Before the Event:

Event Date: October 12, 2016

Unit: 2 Mode: 1 Reactor Power: 90 percent

Unit 2 Reactor Coolant System (RCS) [AB]: Normal operating temperature and pressure

No structures, systems or components were inoperable at the start of this event that contributed to the event.

B. Description of Event:

On October 12, 2016 at 1338 hours, Byron Station Unit 2 was operating at approximately 90% power with the reactor in Mode 1. At 1338 hours operators received an alarm indicating that the feed breaker to Motor Control Center (MCC) 234V4 tripped. The loss of the only power feed to the Feedwater (FW) Water Hammer Prevention System (WHPS) circuit caused the relay contacts to fail closed and caused Feedwater Isolation Valves 2FW009B and 2FW009C to close and decrease water levels in the loop B and loop C Steam Generators. The water hammer prevention system relays for Feedwater Isolation Valves are normally energized such that de-energization of the relays will cause an actuation that would close the associated FW isolation valves. Byron Station Operations initiated a manual reactor trip in response to the decreasing steam generator levels and related low steam generator alarms in the Main Control Room (MCR). The reactor protection system actuated due to the manual reactor trip and performed as expected. The Auxiliary Feedwater system actuated automatically in response to the reactor trip and performed as expected.

Initial troubleshooting was conducted by Byron Station Electrical Maintenance personnel performing an as found inspection on the breaker once the breaker was racked out by Operations. There was no evidence that the breaker was damaged or experienced an internal short. The troubleshooting was not able to directly determine the cause of the loss of power. A replacement breaker was installed and additional testing was planned for the removed breaker.

The station provided Exelon PowerLabs with the Westinghouse DS-206-MO circuit breaker, including its associated amptector, and an extra amptector for comparison testing. PowerLabs performed functional testing and disassembly/inspection of the Feed Breaker. PowerLab's conclusion was that the most likely cause of the circuit breaker tripping before the setpoint was due to the amptector. PowerLabs suggested that the suspect amptector be sent to Quad Plus (outside lab) for further failure analysis.

PowerLabs transferred the suspect amptector to Quad Plus (outside laboratory) on November 2, 2016 for additional failure analysis. The analysis and troubleshooting concluded that the apparent cause of the breaker failure was a manufacturing defect on the amptector (Westinghouse Amptector IIA Serial #000753) circuit board. The failure analysis reports concluded that there was an issue with the suspect reading with Diode (D30), Resistor R22, and the transistor (Q20) combination.

NRC Event Notification (ENS) 52295 was made on October 12, 2016 at 1417 CDT.

The Unit 2 Reactor Protection System was actuated by the manual reactor trip and the Auxiliary Feedwater System actuated automatically as expected. This condition is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) for any event or condition that resulted in manual or automatic actuation of any of the systems listed in 10 CFR 50.73(a)(2)(iv)(B).

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		YEAR	SEQUENTIAL NUMBER	REV NO.
Byron Station – Unit 2	05000455	2016	- 001	- 01

NARRATIVE

C. Cause of Event:

The analysis and troubleshooting concluded that the apparent cause was due to a manufacturing defect on the Amptector (Westinghouse Amptector IIA Serial #000753) circuit board. Laboratory testing was able to identify that the amptector was the cause of the unit trip, and subsequently was able to identify the exact cause of the unit trip down to the component by replacing the diode. A combination of failure analysis reports concluded that there was an issue with the suspect reading with Diode (D30), Resistor R22, and the transistor (Q20). The 3 subcomponents share the same solder joint.

D. Safety Consequences:

There were no safety consequences to this event. The plant operated as designed in this case, with the loss of power causing the WHPS to close the FW Isolation Valves. The unexpected trip of the circuit breaker was a Maintenance Rule Functional Failure. As the circuit breaker is non-safety related, it is not a Safety System Functional Failure.

E. Corrective Actions:

Immediate Actions Completed
1. Performed change out of the feed breaker to MCC 234V4.
2. Performed a prompt investigation in accordance with Exelon Corrective Action Program procedures.

Corrective Actions Planned
1. Revise refurbishment testing requirements for the feed breaker to MCC 234V4 tripped to include steps to verify that the breaker will not trip 75%, 50%, and 25% below the setpoint. Also, during scheduled breaker refurbishment preventive maintenance, cycle Amptector IIA's out for a replacement.
2. Perform modifications in subsequent refuel outages to the FW Water Hammer Prevention System to address power supply single point vulnerability.

F. Previous Occurrences:

There have been no previous Licensee Event Reports at Byron Station on this issue.

G. Component Failure Data:

Manufacturer	Nomenclature	Model	Mfg. Part Number
Westinghouse	CIRCUIT BREAKER	DS-206-MO	S/N 02YN025B4-S